Exercises: #58
Conceptual: 6, 8
Problems: 12, 14, 18, 43, 44
Chapter 9 Homework

$\frac{15}{15}$

Taylor Larrechea

Problems

12\. a. $\vec{A} = 3\hat{i} + 4\hat{j}$ $\quad \vec{B} = 2\hat{i} - 6\hat{j}$
b. $\vec{A} = 3\hat{i} - 2\hat{j}$ $\quad \vec{B} = 6\hat{i} + 4\hat{j}$
$\vec{A} \cdot \vec{B}$

a) $\vec{A} \langle 3, 4 \rangle \cdot \vec{B} \langle 2, -6 \rangle$
$3(2) + 4(-6)$
$6 - 24$
-18

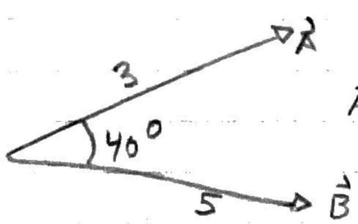
$\vec{A} \cdot \vec{B} = -18$

b.) $\vec{A} \langle 3, -2 \rangle \cdot \vec{B} \langle 6, 4 \rangle$
$3(6) - 2(4)$
$18 - 8$
10

$\vec{A} \cdot \vec{B} = 10$

14\.

a.

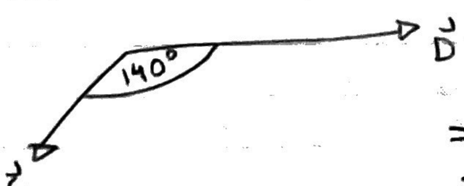


$\boxed{\vec{A} \cdot \vec{B} = 11.5}$

$\vec{A} \cdot \vec{B} = AB\cos\theta$
$= (3)(5)\cos\theta$
$= 15\cos 40$
$\vec{A} \cdot \vec{B} = 11.5$

$a = 3$
$b = 5$
$\theta = 40°$

b.

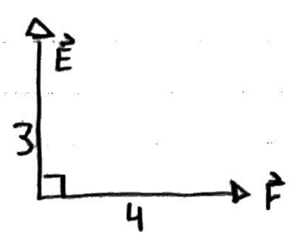


$\vec{C} \cdot \vec{D} = CD\cos\theta$
$= 2(3)\cos 140$
$= 6\cos 140$
$\vec{C} \cdot \vec{D} = -4.6$

$C = 2$
$D = 3$
$\theta = 140$

$\boxed{\vec{C} \cdot \vec{D} = -4.6}$

c.

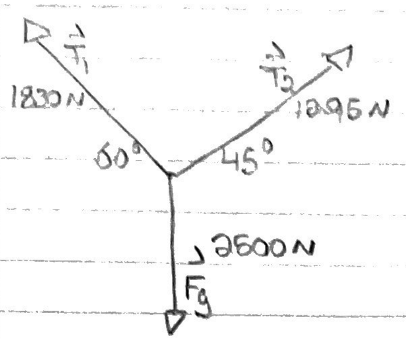


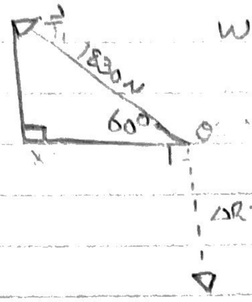
$E = 3$
$F = 4$
$\theta = 90$

$\vec{E} \cdot \vec{F} = EF\cos\theta$
$= 3(4)\cos 90$
$= 12\cos 90$
$\vec{E} \cdot \vec{F} = 0$

$\boxed{\vec{E} \cdot \vec{F} = 0}$

18





$W = \vec{F} \cdot \Delta R \cdot \cos\theta$ $\quad \vec{F} = 1830\text{ N}$

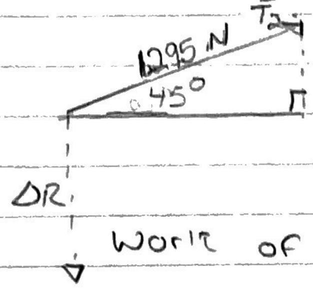
$\theta = 150$

$\Delta r = 5\text{m}$

$= 1830\text{N}(5\text{m})\cos(150)$

$= -7924.1\text{ J}$

Work of T_1 = $\boxed{-7924.1\text{J}}$

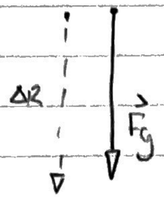


$W = F \cdot \Delta R \cdot \cos\theta$ $\quad \vec{F} = 1295\text{ N}$

$= 1295\text{N}(5\text{m})\cos 135$ $\quad \theta = 135$

$W = -4578.5\text{J}$ $\quad \Delta R = 5\text{m}$

Work of $\vec{T_2}$ = $\boxed{-4578.5\text{J}}$



$W = F \cdot \Delta R \cdot \cos\theta$

$\theta = 0$ $\quad W = 2500\text{N}(5\text{m})\cos(0)$

$\vec{F} = 2500\text{ N}$ $\quad = 12{,}500\text{J}(1)$

$\Delta R = 5\text{m}$ $\quad W = 12{,}500\text{J}$

3/3

Work of gravity = $\boxed{12{,}500\text{J}}$

43. $m = 1000\text{ kg}$

$a = 1.0\text{ m/s}^2$

$\Delta r = 10\text{ m}$

Gravity

a.) $W = F\Delta r\cos\theta$

$= 1000\text{kg}(9.8\text{m/s}^2)10\text{m}\cos(180)$

$= 98{,}000\text{ J}\cos 180$

$= -98{,}000\text{J}$ $\quad$ Gravity work = $\boxed{-98{,}000\text{J}}$

$\Sigma_y = ma$

$\Sigma_y = \vec{T_1} - mg = ma$

$T_1 = mg + ma$

$T_1 = 1000\text{kg}(9.8\text{m/s}^2) + 1000\text{kg}(1\text{m/s}^2)$

$T_1 = 10{,}800\text{N}$

Rope $\quad$ Tension work = $\boxed{108{,}000\text{J}}$

b.) $W = F\Delta r\cos\theta$

$= \vec{T_1}\Delta r\cos\theta$

$= 10{,}800\text{N}(10\text{m})\cos(0)$

$= 108{,}000\text{J}(1)$

6. $Work_{net} = \Delta K$

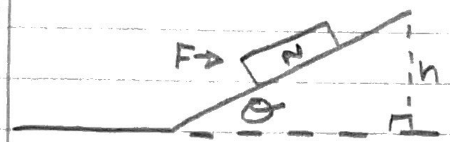
$W_{Rope} + W_{Grav} = \Delta K$

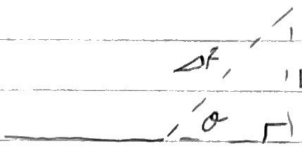
$\cancel{-98{,}000\,J} + 108{,}000\,J = \Delta K$

$\Delta K = 10{,}000\,J$

Kinetic Energy after traveling 10m = $\boxed{10{,}000\,J}$

44





$W = F \cdot \Delta r \cdot \cos\theta$

$\Delta R = \dfrac{h}{\sin\theta}$

$F \cdot \dfrac{h}{\sin\theta} \cdot \cos\theta$

$\Delta K = Work_{net}$

$\Delta K = W_{Gravity} + W_{normal} + W_{Push}$

$W = F\cot\theta\, h$ $\quad FH\cot\theta$

$F\cot\theta H = \frac{1}{2} m v_f^2$

$2F\cot\theta H = m v_f^2$

$\dfrac{2F\cot\theta H}{m} = v_f^2$

$\frac{1}{2}mv^2 = mgh + F\cot h$

$V = \sqrt{\dfrac{2F\cot\theta H}{m}}$

$F = 25\,N$
$m = 5.0\,Kg$
$h = 2m$
$\theta = 20^\circ$

$V = \sqrt{\dfrac{2F\cot\theta H}{m}}$

$V = \sqrt{\dfrac{2(25N)\cot(20)\,2m}{5.0\,Kg}}$

$V = \cancel{41.78}\ m/s$

Conceptual Questions

6. The work done by the particle has to be negative because the push force is opposite the direction of motion. It is also slowing down so the work has to be negative. ✓ 3/3

8.) Since gravity is a conservative force and independent of path, the works of A and B are equal

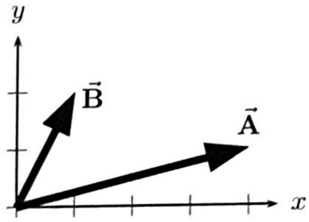
58 Vectors: Dot Products

For each of the following, express $\vec{\mathbf{A}}$ in component form $\vec{\mathbf{B}}$ using unit vectors and determine the dot product, $\vec{\mathbf{A}} \cdot \vec{\mathbf{B}}$. *Note: If your answer for the dot product contains* $\hat{\mathbf{i}}$ *and* $\hat{\mathbf{j}}$ *then it is very incorrect!*

a)

$\vec{A} = \langle 4\hat{i}, 1\hat{j} \rangle$

$\vec{B} = \langle 1\hat{i}, 2\hat{j} \rangle$



$\vec{A} \cdot \vec{B} = 4(1) + 1(2)$

$4 + 2$

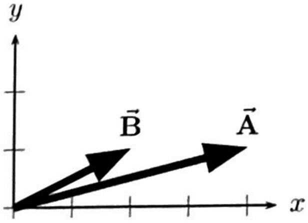
6

$\boxed{\vec{A} \cdot \vec{B} = 6}$

b)

$\vec{A} = \langle 4\hat{i}, 1\hat{j} \rangle$

$\vec{B} = \langle 2\hat{i}, 1\hat{j} \rangle$



$\vec{A} \cdot \vec{B} = 4(2) + 1(1)$

$\boxed{\vec{A} \cdot \vec{B} = 9}$

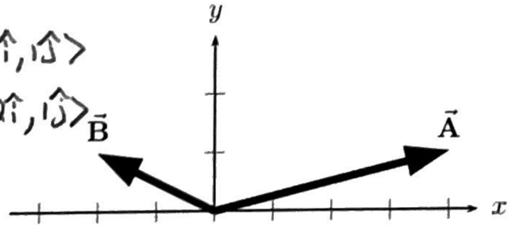
$8 + 1$

9

c)

$\vec{A} = \langle 4\hat{i}, 1\hat{j} \rangle$

$\vec{B} = \langle -2\hat{i}, 1\hat{j} \rangle$



$\vec{A} \cdot \vec{B} = 4(-2) + 1(1)$

$\boxed{\vec{A} \cdot \vec{B} = -7}$

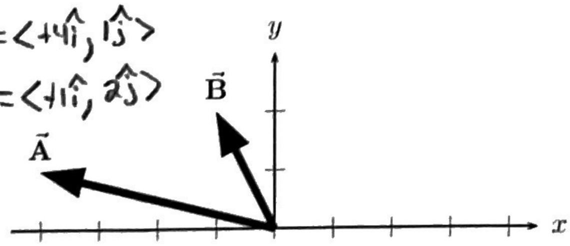
$-8 + 1$

-7

d)

$\vec{A} = \langle -4\hat{i}, 1\hat{j} \rangle$

$\vec{B} = \langle -1\hat{i}, 2\hat{j} \rangle$



$\vec{A} \cdot \vec{B} = -4(-1) + 1(2)$

$\boxed{\vec{A} \cdot \vec{B} = 6}$

$4 + 2$

6